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(54) Abstract Title

Traffic monitoring

(57) An apparatus and method for monitoring traffic comprises a plurality of vehicles (1) fitted with units (2). Each unit (2) comprises a CPU (3), a timer (4) and a GPS device (5). Whenever a vehicle (1) passes a waypoint (A) determined by the GPS device (5), the CPU (3) notes the time supplied by the timer (4). When the vehicle (1) passes the next waypoint (B) determined by the GPS device (5), the CPU (3) notes the time again. The CPU (3) subtracts the two times to derive the actual journey time for the link (C) between the two waypoints (A,B), and this is compared against a stored link-time for the link (C). If the actual journey time is greater by a preset amount than the stored link-time, then the unit (2) transmits the relevant information to a control computer (8) by way of a communication device (6). In addition to notifying the control computer (8) when the vehicle (1) has exceeded a standard time for the link (C) between the waypoints (A,B), the unit (2) can monitor the progress of the vehicle (1) along the link (C) by monitoring its progress along sublinks using a technique known as "micro-pointing".

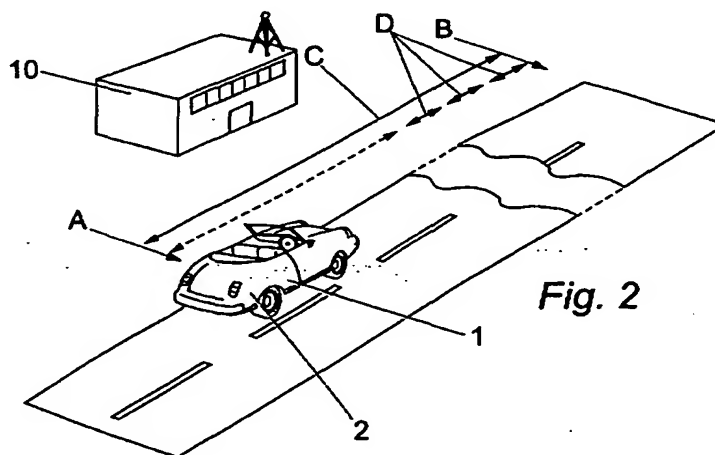


Fig. 2

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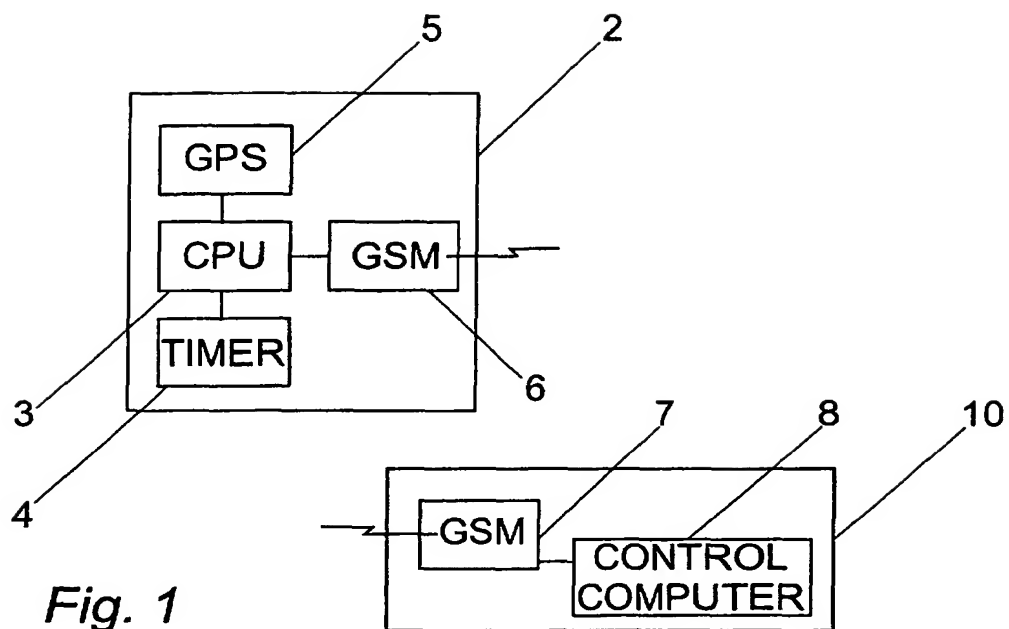


Fig. 1

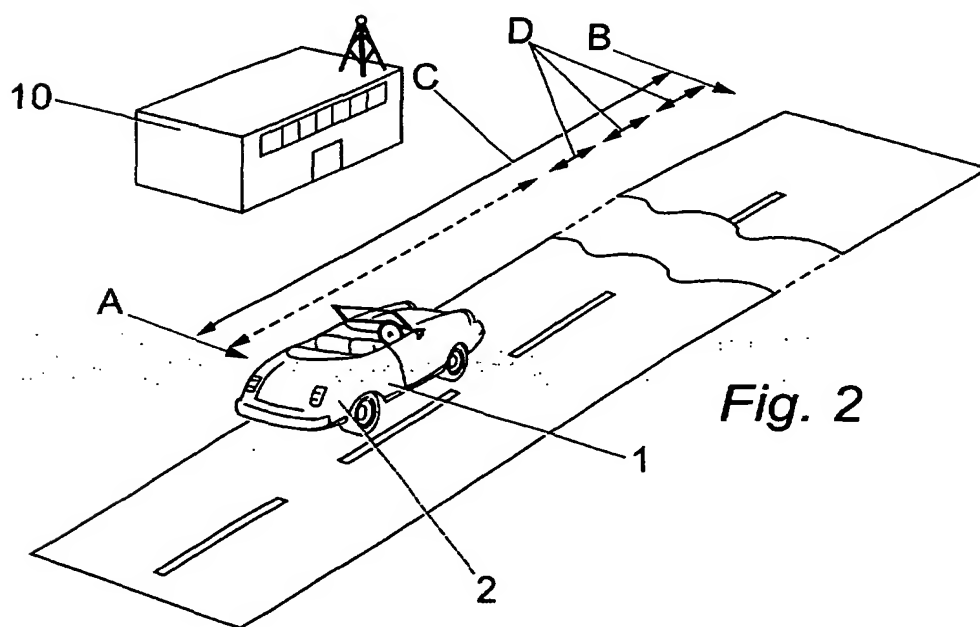


Fig. 2

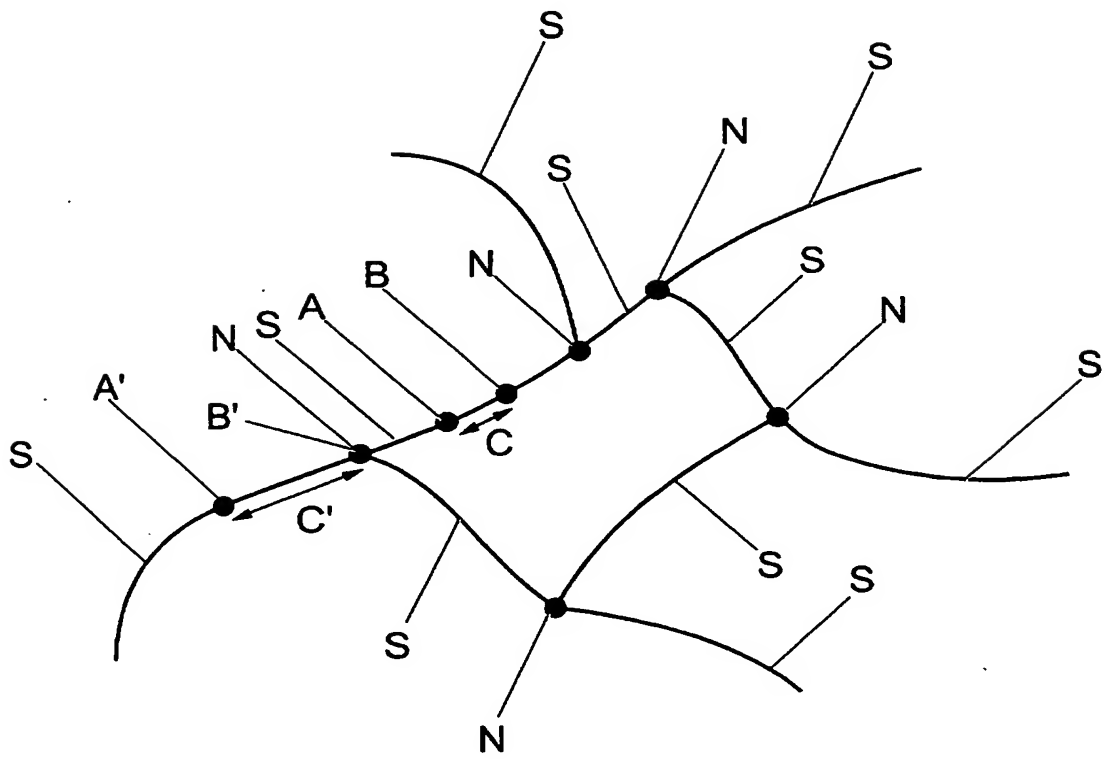


Fig. 3

APPARATUS AND METHOD FOR MONITORING TRAFFIC

1 This invention relates to an apparatus and a method
2 for monitoring traffic and to a method of selecting
3 commencement and termination points for transit time
4 measurements on a road network. In particular this
5 invention relates to an apparatus and a method for
6 monitoring traffic using floating car data.

7
8 The use of floating car data to monitor traffic is
9 known. The method involves fitting a large number of
10 vehicles with equipment which can measure the speed,
11 position and travel direction of the vehicle and
12 which can transmit this information to a central
13 station. A computer at the central station then uses
14 this received data to build a dynamic picture of the
15 traffic on the road network in the region in which
16 the vehicles are operating. The method requires a
17 large number of vehicles to be fitted with the
18 equipment and to be in motion on the road network.

1 The central computer requires a large amount of
2 computing power, and there is a high communication
3 cost in transmitting the floating car data from the
4 vehicles to the central station.

5
6 EP 0 880 120 A2 (Daimler-Benz AG) describes a
7 floating car data method in which the amount of
8 transmitted data is reduced. In this method an
9 automatic position detection is carried out in the
10 sample vehicle at predetermined time intervals. The
11 vehicle is provided with an on-board computer which
12 stores information about the road network and the
13 expected journey duration for sub-sections of the
14 road network. After each position detection is
15 carried out, the on-board computer records the sub-
16 section travelled since the previous position
17 detection and calculates the actual journey duration.
18 Then, using the stored expected journey duration
19 information, the on-board computer calculates either
20 the expected position for the actual journey duration
21 or the expected journey duration for the actual
22 position, compares the expected position or journey
23 duration with the actual position or journey
24 duration, and transmits data relating to the traffic
25 situation only if the difference is greater than a
26 predetermined threshold.

27
28 WO 98/12682 (Detemobil) describes a floating car data
29 method in which the amount of transmitted data is
30 reduced. In this method each vehicle is provided
31 with a decentralised unit which is able to determine

1 position and to transmit and receive data by mobile
2 communication. A central unit at a central station
3 is allocated to several decentralised units. Each
4 decentralised unit contains a database of road
5 network information which is a subset of the database
6 of road network information contained by the central
7 unit. The central unit activates programs stored in
8 the decentralised unit through control signals
9 transmitted from the central station to the vehicle.
10 The reporting of traffic data from the decentralised
11 unit to the central unit is controlled by the
12 programs according to predetermined criteria.

13
14 The existing methods utilise a road network model
15 which has a number of predetermined subsections or
16 detection points. Motion of the vehicles is measured
17 with respect to these predetermined subsections or
18 detection points. If greater detail is required
19 about the motion of the vehicles, then a road network
20 model with a greater density of subsections or points
21 must be used, which greatly increases the
22 communication and processing requirements of the
23 system.

24
25 It is an object of the present invention to provide
26 an apparatus and a method for monitoring traffic
27 which enables more efficient monitoring in greater
28 detail of a particular part of the road network
29 without requiring increased communication and
30 processing capacity.

31

1 According to a first aspect of the present invention,
2 there is provided a method of selecting commencement
3 and termination points on a road network for transit
4 time measurements on a road network, wherein at least
5 one point for at least one of the roads of the
6 network is selected without that selection being
7 determined by any other road of the network. The
8 commencement and termination points are physical,
9 geographical locations on the road network.
10
11 Preferably the road network comprises a plurality of
12 node points interconnected by a plurality of route
13 segments, each node point having at least three route
14 segments associated with it. Preferably the at least
15 one point is not coincident with any one of said
16 plurality of node points.
17
18 Preferably the selection of the commencement and
19 termination points takes place at a control centre.
20 Preferably data defining the positions of the
21 commencement and termination points is communicated
22 from the control centre to a plurality of vehicles
23 equipped to measure the transit time between the
24 commencement and termination points and to
25 communicate data relating to the measured transit
26 time back to the control centre.
27
28 Preferably data defining the predicted transit time
29 between the commencement and termination points is
30 communicated from the control centre to the plurality
31 of vehicles. Preferably each vehicle is equipped to

1 compare the measured transit time with the predicted
2 transit time and to communicate data relating to the
3 measured transit time back to the control centre only
4 if the difference between the measured transit time
5 and the predicted transit time exceeds a threshold
6 value. The parameters defining the threshold value
7 may also be communicated from the control centre to
8 the plurality of vehicles.

9
10 According to a second aspect of the present
11 invention, there is provided an apparatus for
12 monitoring traffic, including a memory in which is
13 recorded a programme for selecting commencement and
14 termination points for transit time measurements on a
15 road network, wherein the programme selects at least
16 one point of said commencement and termination points
17 for at least one of the roads of the network without
18 that selection being determined by any other road of
19 the network. The commencement and termination points
20 are physical, geographical locations on the road
21 network.

22
23 Preferably the road network comprises a plurality of
24 node points interconnected by a plurality of route
25 segments, each node point having at least three route
26 segments associated with it. Preferably the at least
27 one point is not coincident with any one of said
28 plurality of node points.

29
30 Preferably the memory is in a control centre.
31 Preferably the control centre includes communication

1 means adapted to transmit data defining the positions
2 of the commencement and termination points from the
3 control centre to a plurality of vehicles equipped to
4 measure the transit time between the commencement and
5 termination points. Preferably the communication
6 means is adapted to receive data relating to the
7 measured transit time from the vehicles.

8
9 Preferably there is recorded in the memory a
10 programme for defining the predicted transit time
11 between the commencement and termination points,
12 wherein the programme calculates a predicted transit
13 time dependent on one or more of the location of the
14 points, the monitored traffic conditions and the time
15 of day. Preferably the communication means is
16 adapted to transmit data relating to the predicted
17 transit time.

18
19 Owing to these aspects of the invention, it is
20 possible to split up a road network for calculating
21 transit times on that network without the splitting
22 being predetermined by the make-up of the network,
23 thereby giving complete flexibility in the choice of
24 the location of the commencement and the termination
25 points.

26
27 According to a third aspect of the present invention,
28 there is provided a method of monitoring traffic
29 comprising:

30

1 selecting a commencement point and a termination
2 point,
3
4 communicating positional data for the commencement
5 point and termination point to each of a plurality of
6 vehicles,
7
8 at each of the plurality of vehicles monitoring when
9 the vehicle passes from the commencement point to the
10 termination point and calculating the transit time
11 taken for the vehicle to travel between the two
12 points,
13
14 comparing the transit time taken with a standard
15 transit time for travel between the two points, and
16
17 communicating with a control centre if said transit
18 time taken exceeds the said standard transit time by
19 more than a preset amount.
20
21 The standard transit time and the preset amount may
22 be selected at the control centre and communicated to
23 each of the plurality of vehicles. The standard
24 transit time and the preset amount may vary according
25 to one or more of the location of the points, the
26 monitored traffic conditions and the time of day.
27
28 According to a fourth aspect of the present
29 invention, there is provided apparatus for monitoring
30 traffic comprising a plurality of arrangements each
31 carried by respective vehicles, each arrangement

1 comprising calculating means for calculating the
2 transit time taken to travel between two points and
3 for comparing the transit time taken with a standard
4 transit time for travel between the two points and
5 communicating means communicating with a control
6 centre if said transit time taken exceeds the said
7 standard transit time by more than a preset amount.

8

9 Preferably said communicating means is adapted to
10 receive information from the control centre defining
11 the position of at least one of the two points.
12 Preferably the two points are a commencement point
13 and a termination point respectively.

14

15 Owing to these aspects of the invention, it is
16 possible to provide an in-vehicle traffic monitoring
17 system in which the amount of data that needs to be
18 transmitted to a control centre is minimised.

19

20 According to a fifth aspect of the present invention,
21 there is provided a method of monitoring traffic
22 comprising:

23

24 establishing along a road first and second points at
25 respective ends of a route segment along which a
26 vehicle is to travel, the route segment being
27 subdivided into a number of links,

28

29 at the vehicle, calculating in turn the transit times
30 taken for the vehicle to travel along respective
31 links of the route segment,

1
2 in turn comparing the transit times taken with
3 expected transit times for the respective links, and
4
5 communicating with a control centre if and when any
6 of the transit times taken exceeds the corresponding
7 expected transit time by a predetermined threshold.

8
9 Preferably each link extends from a commencement
10 point to a termination point. Preferably the control
11 centre transmits to the vehicle information defining
12 the position of at least one of the said commencement
13 point and termination point.

14
15 According to a sixth aspect of the present invention,
16 there is provided apparatus for monitoring traffic
17 comprising:

18
19 establishing means arranged to establish along a road
20 first and second points at respective ends of a route
21 segment along which a vehicle is to travel, the route
22 segment being subdivided into a number of links, and

23
24 an arrangement to be carried by the vehicle and
25 comprising calculating means which serves to
26 calculate in turn the transit times taken for the
27 vehicle to travel along the said links, comparing
28 means which serves to compare in turn the transit
29 times taken with expected transit times for the
30 respective links, and communicating means which serve
31 to communicate with a control centre if and when any

1 of said transit times taken significantly exceeds to
2 corresponding expected transit time.

3

4 Preferably each link extends from a commencement
5 point to a termination point. Preferably said
6 communicating means is adapted to receive information
7 from the control centre defining the position of at
8 least one of the said commencement point and
9 termination point.

10

11 Owing to these aspects of the invention, a relatively
12 fast notification of a sudden incident, such as a
13 road accident, can be obtained.

14

15 In order that the invention may be clearly and
16 completely disclosed, reference will now be made, by
17 way of example, to the accompanying drawing, in
18 which:

19

20 Fig 1 is a diagram of parts of a traffic monitoring
21 system,

22 Fig 2 is a diagrammatic perspective view of the
23 system, and

24 Fig 3 is a schematic view of a road network.

25

26 Referring to the drawing, a vehicle 1 is fitted with
27 an arrangement in the form of a unit 2 that includes
28 a central processing unit (CPU) 3. The CPU 3
29 includes a memory store. The CPU 3 is connected to
30 an accurate time-measuring device 4, for example a
31 crystal-controlled clock. The CPU 3 is also

1 connected to a Global Positioning System (GPS) device
2 5 and to a two-way communication device 6, for
3 example a GSM cellular telephone. Such units are
4 known and the data transmitted by such a unit is
5 referred to as floating car data. Instead of the GPS
6 device other positioning systems may be used, for
7 example triangulation using mobile telephony.

8
9 The traffic monitoring system comprises a plurality
10 of motor vehicles (including the vehicle 1) fitted
11 with respective units 2, each unit 2 being capable of
12 bi-directional communication, via the communication
13 device 6, and a central two-way communication device
14 7, for example a GSM apparatus, with a central
15 control computer 8 at a control centre 10. The
16 system can monitor road traffic congestion in real
17 time.

18
19 The memory of each unit 2 is loaded with geographic
20 locations of specific points on roads, which are
21 called "waypoints" for the purpose of this
22 application. A waypoint needs no association with
23 anything physical other than being on a road. For
24 example, a waypoint does not need to be associated
25 with a specific location such as a road junction or a
26 crossroads, nor with a detector at a specific
27 location, such as a bridge, along the road. There
28 are no restrictions on the number of waypoints which
29 may exist or their locations on the road. Each
30 waypoint is a known distance from the next waypoint
31 along the road, and the geographic distances between

1 them is called a "link". There are usually, but not
2 necessarily, two links between two waypoints, one for
3 each direction of travel. The memory of each unit 2
4 is also loaded with estimated journey times along the
5 links. These estimated journey times are called
6 "link-times". There may be several link-times for
7 each link, since the estimated journey time may
8 change during the day, or for other reasons, such as
9 roadworks. In Fig 2, two waypoints A and B are
10 indicated, separated by a link C.

11
12 Fig 3 shows how the waypoints A and B, separated by
13 link C, do not need to correspond to node points N in
14 the road network. Each of the node points N is
15 associated with three or more road segments S.
16 However if required one or more waypoints may
17 correspond to a node point N, as indicated by link C'
18 joining waypoints A' and B', in which waypoint B'
19 corresponds to a node point N.

20
21 In operation, whenever the vehicle 1 passes a
22 waypoint A as determined by the device 5, the CPU 3
23 notes the time supplied by the timer 4. When the
24 vehicle 1 passes the next waypoint B as determined by
25 the device 5, the CPU notes the time again. The CPU
26 3 subtracts the two times to derive the actual
27 journey time for the link C, and this is compared
28 against the stored link-time for the link C. The
29 results are stored in the unit 2 on a rolling basis.
30

1 If and when the actual journey time is greater by a
2 preset amount than the stored link-time, then by
3 means of the communication device 6 the unit 2
4 transmits the relevant information (normally the
5 actual journey time, but optionally other relevant
6 information such as the deviation, position and
7 absolute time) to the control computer 8 as soon as
8 it is possible to do so. The preset amount may be
9 fixed for the particular link, or may be the result
10 of a calculation for example based on deviation above
11 a specific percentage. If the actual journey time is
12 less than the stored link-time, no transmission is
13 made.

14
15 The control computer 8 receives deviations from the
16 normal link-times from a plurality of vehicles, and
17 from these calculates traffic flow and congestion,
18 using one of several calculation methods already
19 publicly known. Lower than expected speeds on a road
20 are a reliable indicator of congestion.

21
22 Additionally, the unit 2 may upload its entire
23 rolling record of actual journey times to the
24 computer 8, which may use it to refine the accuracy
25 of the link-times held in the CPU 3, using one of
26 several calculation methods already publicly known.

27
28 Additionally, the computer 8 may download new
29 information to the in-vehicle CPU 3, to modify its
30 memory store of waypoints and link-times.

31

1 This approach to traffic congestion measurement gives
2 a minimal communication cost, since each vehicle need
3 transmit only one short message at the end of a link
4 where there is congestion.

5
6 The use of waypoints removes all need for transit
7 segments to be related to geographic or physical
8 entities other than a road or roads, and is not
9 limited to use with any particular form of
10 navigation. Moreover the use of waypoints allows the
11 resolution of monitoring to be infinitely varied
12 along the length(s) of a road or roads. Waypoints
13 can also be dynamically allocated. The number of
14 waypoints on a particular section of road can vary
15 according to the time of day, the day of the week,
16 and/or the season, as appropriate. This variability
17 of waypoints leads to a high degree of flexibility.
18 More waypoints would be used when traffic is expected
19 to be heavier and so more accurate information is
20 obtained.

21
22 The statistical resolution, and hence accuracy, of
23 such a system is dependent on the percentage of
24 vehicles carrying units 2. Whenever the percentage
25 is low, waypoints and link-times are defined
26 preferably for only congested areas of motorway. As
27 the number of equipped vehicles increases, coverage
28 can be extended to all motorways and, ultimately, to
29 any road with a statistically viable sample of
30 vehicles.

31

1 In addition to notifying the control centre 10 when
2 the vehicle 1 has exceeded a standard time for the
3 link C between two waypoints A, B, the unit 2 can
4 monitor the progress of the vehicle along the link C
5 by monitoring its progress along sublinks. This
6 technique is given the name "micro-pointing". For
7 example, if a vehicle has 10km to travel between two
8 waypoints A, B and it normally takes a link-time of
9 ten minutes to travel this distance, the unit 2 can
10 divide the link C into sublinks D, for example ten
11 sublinks of one minute each. Using the GPS 5 to
12 identify when each one-kilometre sublink D has been
13 completed, the unit 2 notes the time taken for each
14 sublink D. The unit 2 notifies the control centre 10
15 when the time for a sublink D greatly exceeds the
16 expected amount. In the above example a time of one
17 minute 20 seconds for a sublink would not be
18 perceived as resulting from a problem. However a
19 time of three minutes for a sublink would result in
20 the unit notifying the control centre 10 accordingly.
21 If only one unit 2, corresponding to only one vehicle
22 1, notifies the control centre 10, this would not
23 necessarily mean that an incident, for example a road
24 accident, affecting traffic flow generally has
25 occurred. However, if a plurality of units 2, say
26 four or more units 2 corresponding to four or more
27 vehicles 1, all notify the control centre 10 at
28 approximately the same time concerning the same
29 sublink D, or possibly the same link C, then this
30 would indicate the presence of an incident. Thus, if
31 a sudden, great change in the sublink time occurs,

1 the unit 2 communicates this immediately to the
2 control centre 10, giving relatively fast
3 notification of an incident compared with the unit 2
4 notifying the centre 10 either when the link-time has
5 been greatly exceeded or even when the unit reaches
6 the waypoint B at the end of the link C. Again, the
7 degree of micro-pointing, i.e. the number of sublinks
8 D into which any particular link C is divided, can be
9 varied according to the time of day, the day of the
10 week, or the season, as appropriate.

11

12 The method and apparatus of the invention offers
13 significant advantages over prior art traffic
14 monitoring systems. It offers a fast response to
15 traffic situations, since it can quickly report
16 changes in sublink times. It offers low
17 communications costs, since data is only transmitted
18 from the vehicle to the central station when a
19 predetermined threshold is reached. Most in-vehicle
20 measurements will not be reported. It can generate
21 meaningful statistical traffic information from a
22 single vehicle, since the progress of a single
23 vehicle over a number of adjacent links or sublinks
24 can be monitored. Road coverage can be dynamically
25 extended as the population of equipped vehicles
26 increases, simply by defining additional waypoints.
27 Reporting parameters can be dynamically varied,
28 giving the most appropriate balance between accuracy,
29 response and communications cost at any time. For
30 example the linktime, and hence the threshold at
31 which reporting takes place, can be varied according

1 to the time of day so that the threshold is higher in
2 the rush hour than outside peak travel times.

3

4 It should be noted that each vehicle 1 is equipped
5 identically with the same unit 2. Each unit 2
6 communicates only with the central station 10, and
7 units 2 do not communicate with each other.

8

9 The units 2 do not measure speed against time
10 intervals, nor do they use the measurement of
11 velocity from a GPS receiver. Instead a unit 2
12 measures the time of travel between a first waypoint
13 and a second waypoint, and compares this measured
14 time with a control, namely the linktime stored in
15 the memory of the unit 2. Waypoints are defined at
16 the central station, not at the unit 2 in the
17 vehicle. The definition of waypoints may be dynamic,
18 so that the central station 10 communicates to each
19 unit updated waypoint definition data according to
20 traffic conditions monitored at the central station,
21 or the definition of waypoints may be preset in each
22 unit, so that updating of waypoint information in the
23 units only takes place at particular times.

24

25 Waypoints do not need to correspond to road
26 junctions, although they can do. The only geographic
27 limitation on a waypoint is that it corresponds to a
28 position on a road forming part of the road network
29 to be monitored. A waypoint is a virtual reference
30 point and does not have to correspond to any physical
31 feature.

1
2 Modifications and improvements may be made to the
3 embodiments without departing from the scope of the
4 invention. For instance, any positioning system 5
5 may be used in the unit 2 in each vehicle 1, and the
6 invention is not limited to GPS systems. Indeed the
7 unit 2 does not need a navigation system. Any form
8 of communication system 5 may be used in the unit 2
9 in each vehicle 1, and the invention is not limited
10 to GSM systems. If the possibility of the control
11 computer 8 defining new waypoints is not required,
12 then the communication system 5 may be a one way
13 system, used only to transmit data from the vehicle 1
14 to the control centre 10, with all waypoint
15 information being provided in pre-programmed form,
16 for example on a CD-ROM or other readable storage
17 device.
18

CLAIMS:

- 1 1. A method of selecting commencement and
2 termination points on a road network for transit
3 time measurements on the road network, wherein at
4 least one point for at least one of the roads of
5 the network is selected without that selection
6 being determined by any other road of the network.
7
- 8 2. The method of Claim 1, wherein the road network
9 comprises a plurality of node points
10 interconnected by a plurality of route segments,
11 each node point having at least three route
12 segments associated with it.
13
- 14 3. The method of Claim 2, wherein the at least one
15 point is not coincident with any one of said
16 plurality of node points.
17
- 18 4. The method of any preceding claim, wherein the
19 selection of the commencement and termination
20 points takes place at a control centre.
21
- 22 5. The method of Claim 4, wherein data defining the
23 positions of the commencement and termination
24 points is communicated from the control centre to
25 a plurality of vehicles equipped to measure the
26 transit time between the commencement and
27 termination points and to communicate data
28 relating to the measured transit time back to the
29 control centre.

- 1
2 6. The method of Claim 5, wherein data defining the
3 predicted transit time between the commencement
4 and termination points is communicated from the
5 control centre to the plurality of vehicles.
6
- 7 7. The method of Claim 6, wherein each vehicle is
8 equipped to compare the measured transit time with
9 the predicted transit time and to communicate data
10 relating to the measured transit time back to the
11 control centre only if the difference between the
12 measured transit time and the predicted transit
13 time exceeds a threshold value.
14
- 15 8. The method of Claim 7, wherein the parameters
16 defining the threshold value may also be
17 communicated from the control centre to the
18 plurality of vehicles.
19
- 20 9. An apparatus for monitoring traffic, including a
21 memory in which is recorded a programme for
22 selecting commencement and termination points on a
23 road network for transit time measurements on the
24 road network, wherein the programme selects at
25 least one point of said commencement and
26 termination points for at least one of the roads
27 of the network without that selection being
28 determined by any other road of the network.
29
- 30 10. The apparatus of Claim 9, wherein the road
31 network comprises a plurality of node points

1 interconnected by a plurality of route segments,
2 each node point having at least three route
3 segments associated with it.

4

5 11. The apparatus of Claim 10, wherein the at least
6 one point is not coincident with any one of said
7 plurality of node points.

8

9 12. The apparatus of any of Claims 9 to 11, wherein
10 the memory is in a control centre.

11

12 13. The apparatus of Claim 12, wherein the control
13 centre includes communication means adapted to
14 transmit data defining the positions of the
15 commencement and termination points from the
16 control centre to a plurality of vehicles equipped
17 to measure the transit time between the
18 commencement and termination points.

19

20 14. The apparatus of Claim 13, wherein the
21 communication means is adapted to receive data
22 relating to the measured transit time from the
23 vehicles.

24

25 15. The apparatus of either Claim 13 or Claim 14,
26 wherein the communication means is adapted to
27 transmit data relating to the predicted transit
28 time.

29

30 16. The apparatus of any of Claims 9 to 15, wherein
31 there is recorded in the memory a programme for

1 defining the predicted transit time between the
2 commencement and termination points, wherein the
3 programme calculates a predicted transit time
4 dependent on one or more of the location of the
5 points, the monitored traffic conditions and the
6 time of day.

7

8 17. A method of monitoring traffic comprising:
9 selecting a commencement point and a termination
10 point on a road network,
11 communicating positional data for the commencement
12 point and termination point to each of a plurality
13 of vehicles,
14 at each of the plurality of vehicles monitoring
15 when the vehicle passes from the commencement
16 point to the termination point and calculating the
17 transit time taken for the vehicle to travel
18 between the two points,
19 comparing the transit time taken with a standard
20 transit time for travel between the two points,
21 and
22 communicating with a control centre if said
23 transit time taken exceeds the said standard
24 transit time by more than a preset amount.

25

26 18. The method of Claim 17, wherein the standard
27 transit time and the preset amount are selected at
28 the control centre and communicated to each of the
29 plurality of vehicles.

30

- 1 19. The method of either Claim 17 or Claim 18,
2 wherein the standard transit time and the preset
3 amount vary according to one or more of the
4 location of the points, the monitored traffic
5 conditions and the time of day.
6
- 7 20. An apparatus for monitoring traffic in a road
8 network comprising a plurality of arrangements
9 each carried by respective vehicles, each
10 arrangement comprising calculating means for
11 calculating the transit time taken to travel
12 between two points and for comparing the transit
13 time taken with a standard transit time for travel
14 between the two points and communicating means
15 communicating with a control centre if said
16 transit time taken exceeds the said standard
17 transit time by more than a preset amount, wherein
18 said communicating means is adapted to receive
19 information from the control centre defining the
20 position on the road network of at least one of
21 the two points.
22
- 23 21. The apparatus of Claim 20, wherein the two
24 points are a commencement point and a termination
25 point respectively.
26
- 27 22. A method of monitoring traffic comprising:
28 establishing along a road first and second
29 points at respective ends of a route segment along
30 which a vehicle is to travel, the route segment
31 being subdivided into a number of links,

1 at the vehicle, calculating in turn the transit
2 times taken for the vehicle to travel along
3 respective links of the route segment,
4 in turn comparing the transit times taken with
5 expected transit times for the respective links,
6 and

7 communicating with a control centre if and when
8 any of the transit times taken exceeds the
9 corresponding expected transit time by a
10 predetermined threshold.

11

12 23. The method of Claim 22, wherein each link
13 extends from a commencement point to a termination
14 point.

15

16 24. The method of Claim 23, wherein the control
17 centre transmits to the vehicle information
18 defining the position of at least one of the said
19 commencement point and termination point.

20

21 25. An apparatus for monitoring traffic comprising:
22 establishing means arranged to establish along a
23 road first and second points at respective ends of
24 a route segment along which a vehicle is to
25 travel, the route segment being subdivided into a
26 number of links, and

27 an arrangement to be carried by the vehicle and
28 comprising calculating means which serves to
29 calculate in turn the transit times taken for the
30 vehicle to travel along the said links, comparing
31 means which serves to compare in turn the transit

1 times taken with expected transit times for the
2 respective links, and communicating means which
3 serve to communicate with a control centre if and
4 when any of said transit times taken significantly
5 exceeds to corresponding expected transit time.

6

7 26. The apparatus of Claim 25, wherein each link
8 extends from a commencement point to a termination
9 point.

10

11 27. The apparatus of Claim 26, wherein said
12 communicating means is adapted to receive
13 information from the control centre defining the
14 position of at least one of the said commencement
15 point and termination point.

16

17 28. A method of selecting commencement and
18 termination points for transit time measurements
19 on a road network substantially as hereinbefore
20 described with reference to the accompanying
21 drawings.

22

23 29. An apparatus for monitoring traffic
24 substantially as hereinbefore described with
25 reference to the accompanying drawings.

26

27 30. A method of monitoring traffic substantially as
28 hereinbefore described with reference to the
29 accompanying drawings.



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Other: Online: WPI, EPODOC, PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	EP 0902406 A2 (MANNESMANN) see abstract and figure	1 and 9 to 12
X	EP 0605848 A1 (UNION SWITCH) column 7	1 and 9 to 12
X,E	WO 00/31705 A2 (LANG)	1 and 9 to 12
X	WO 98/27524 A1 (MANNESMAN) see abstract and figure 1	1 and 9 to 12
X	WO 95/14292 A1 (PHILIPS)	1 and 9 to 12

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.